CLAIMS

1. A method for producing Ti or a Ti alloy through reduction by Ca, the method comprising:

a reduction step of holding a molten salt in a reactor vessel, said molten salt containing $CaCl_2$, Ca being dissolved in said molten salt, and of reacting a metallic chloride containing $TiCl_4$ with Ca in the molten salt to generate Ti particles or Ti alloy particles in said molten salt; and

a separation step of separating the Ti particles or Ti alloy particles, generated in said molten salt, from said molten salt.

2. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 1, wherein said molten salt containing $CaCl_2$ is a molten salt containing $CaCl_2$ and NaCl.

3. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 1, wherein said metallic chloride containing $TiCl_4$ is mixed gas containing $TiCl_4$ and another metallic chloride.

4. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 1, wherein, by holdin a molten metal containing Ca on a molten salt, Ca is supplied from said molten metal to said molten salt, located in a lower portion.

5. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 4, wherein said molten metal containing Ca is a molten metal containing Ca and Mg.

6. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 1, wherein $CaCl_2$ which is of a by-product associated with the generation of Ti or the Ti alloy is discharged outside the reactor vessel.

7. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 6, comprising a step of electrolyzing $CaCl_2$ extracted outside the reactor vessel into Ca and Cl_2, wherein Ca generated by the electrolysis step is used for the generation reaction of Ti or the Ti alloy in

the reactor vessel.

8. A method for producing Ti or a Ti alloy through a reduction reaction by Ca, the method comprising:

a reduction step of holding a molten salt in a reactor vessel, said molten salt containing $CaCl_2$, Ca being dissolved in said molten salt, and of reacting a metallic chloride containing $TiCl_4$ with Ca in the molten salt to generate Ti particles or Ti alloy particles in said molten salt;

a discharge step of discharging the molten salt outside said reactor vessel, the molten salt being used for the generation of said Ti particles or Ti alloy particles;

a Ti separation step of separating said Ti particles or Ti alloy particles from the molten salt inside said reactor vessel or outside said reactor vessel;

an electrolysis step of electrolyzing the molten salt to generate Ca, the molten salt being discharged outside said reactor vessel; and

a return step of introducing Ca solely or along with the molten salt into said reactor vessel, Ca being generated by said electrolysis,

wherein a Ca source is circulated.

9. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 8, wherein, in said return step, Ca generated by the electrolysis is dissolved in the molten salt and introduced into said reactor vessel, Ca being generated by said electrolysis.

10. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 8, wherein the Ti particles or Ti alloy particles generated in the reactor vessel is discharged along with said molten salt outside the reactor vessel in said discharge step, and wherein the Ti particles or Ti alloy particles is separated from the molten salt discharged outside the reactor vessel in said Ti separation step, and wherein the molten salt from which the Ti particles or Ti alloy particles is separated and removed is electrolyzed

in said electrolysis step.

11. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 8, comprising a chlorination step of reacting Cl_2 with TiO_2 to generate $TiCl_4$, Cl_2 being of a by-product in said electrolysis step,

wherein $TiCl_4$ generated in the chlorination step is used for the generation reaction of Ti or the Ti alloy in the reactor vessel.

12. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 8, wherein said molten salt is a mixed molten salt containing $CaCl_2$ and NaCl.

13. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 12, wherein said mixed molten salt contains $CaCl_2$ and NaCl with a mixed ratio so that the melting point becomes 600 °C or lower, and said mixed molten salt is maintained at the temperature of not less than the melting point and not higher than 600 °C in at least said reduction step.

14. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 13, comprising a Na separation step of generating Na, while the molten salt discharged from said reactor vessel is maintained at a temperature of higher than 600 °C before the molten salt is supplied to said electrolysis step, and of separating and removing Na thus generated.

15. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 8, wherein said metallic chloride containing $TiCl_4$ is a mixture containing $TiCl_4$ and other metallic chloride.

16. A method for producing Ti or a Ti alloy through reduction by Ca according to claim 8, wherein, by holding the molten metal containing Ca on the molten salt in the reactor vessel, Ca is supplied from said molten metal to said molten salt, located in a lower portion..

17. A method for producing Ti through reduction by Ca, the method comprising:

a reduction step of holding a molten salt in a reactor vessel, said molten salt containing $CaCl_2$, Ca being dissolved in said molten salt, and of reacting a metallic chloride containing $TiCl_4$ with Ca in the molten salt to generate Ti particles in said molten salt; and

a separation step of separating the Ti particles, generated in said molten salt, from said molten salt,

wherein a Ca concentration C (mass %) of the molten salt in said reactor vessel is C > 0 mass % and a temperature of the molten salt ranges from 500 to 1000 °C.

18. A method for producing Ti through reduction by Ca, in which a molten salt whose Ca concentration is increased is used for reduction of $TiCl_4$ in a reduction step, the molten salt being generated in an electrolysis step, the method comprising:

the reduction step of holding a molten salt in a reactor vessel, said molten salt containing $CaCl_2$, Ca being dissolved in said molten salt, and of reacting a metallic chloride containing $TiCl_4$ with Ca in the molten salt to generate Ti particles in said molten salt;

a separation step of separating the Ti particles, generated in said molten salt, from said molten salt;

a separation step of separating the Ti particles, generated in said molten salt, from said molten salt; and

the electrolysis step of increasing the Ca concentration by electrolyzing the molten salt in which the Ca concentration is decreased in association with the generation of the Ti particles,

wherein a Ca concentration C (mass %) of the molten salt in said reactor vessel is C > 0 mass % and a temperature of the molten salt ranges from 500 to 1000 °C.

19. A method for producing Ti through reduction by Ca according to claims 17 or 18, in which the Ca concentration C (mass %) of the molten salt

in said reactor vessel is ≥ 0.005 mass %, the temperature of the molten salt ranges from 550 to 950 °C, and a relationship between said Ca concentration C (mass %) and the temperature of the molten salt satisfies the following formula (1):

$$C \geq 0.002 \times T - 1.5 \quad (1)$$

where T is a temperature (°C) of the molten salt in the reactor vessel.

20. A method for producing Ti through reduction by Ca according to claims 17 or 18, in which said molten salt containing $CaCl_2$ is a molten salt containing $CaCl_2$ and NaCl.

21. A method for producing Ti through reduction by Ca according to claim 17, wherein $CaCl_2$ which is of a by-product associated with the generation of Ti is discharged outside the reactor vessel.

22. A method for producing Ti through reduction by Ca according to claim 21, comprising a step of electrolyzing $CaCl_2$ extracted outside the reactor vessel into Ca and Cl_2, wherein Ca generated by the electrolysis step is used for a generation reaction of Ti in the reactor vessel.

23. A method for producing Ti through reduction by Ca according to claim 18, comprising a chlorination step of reacting Cl_2 with TiO_2 to generate $TiCl_4$, Cl_2 being generated in the electrolysis step, wherein $TiCl_4$ generated in the chlorination step is used for the generation reaction of Ti in the reactor vessel.